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A STUDY OF THE INFANT'S FEEDING REACTIONS DURING THE FIRST SIX MONTHS OF LIFE

BY
ROWENA RIPIN, Ph.D.

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A Study of the Infant's Feeding Reactions During the First Six Months of Life.

1. Statement of the Problem and Procedure

No mention need be made here of the biological importance of the nourishing process. The psychological aspect of this function, however, has received little recognition and less attention. This neglect is a serious one for the psychology of the infant, since feeding reactions play a definite and important rôle in the child's behavior from the very first day of his life. Sucking is one of the very few unlearned activities found at birth, and the first directed as well as the first positive reactions are to be observed in connection with the taking of nourishment. The peculiarity and significance of these reactions have forced themselves upon man's attention throughout the ages, with remarks on the sucking instinct recorded as far back as Hippocrates. But in spite of this long history there have been few contributions to the problem, and scarcely any systematic observations or experimentation has sought to reveal the factors involved or to inform us as to the laws and norms of its development. Bechterew (1), with his associates, is the only one to have attempted an intensive investigation, which was restricted to a study of conditioning processes in nursed infants. Gesell (9) speaks of the specific reactions of the 5-months child to the bottle, but these and other remarks, in so far as one can judge, are based upon casual or general impressions rather than controlled observations.

The interest and value of such a controlled investigation is assured by the peculiar nature of the nourishment situation itself with its frequent recurrence and monopoly of a large proportion of the infant's waking time. Approximately one fourth of the new-born baby's waking day is spent in taking nourishment (5). Consequently, as Stern (21) has pointed out, many types of activity and mental processes are first manifested in connection with the bottle. Nothing else is object of such oft repeated experience or becomes so closely connected

with feeling tones and emotional states. It would then seem that the infant's feeding reactions form appropriate and essential subject matter for observation preliminary to the further study of early directed activity, of learning, desiring, and the like.

The starting point for this investigation was a question suggested by Professor Charlotte Bühler, namely, When does the baby recognize the bottle? A thorough consideration of this problem showed the involvement of a great many factors and led to further related research, so that the scope of the work widened and grew to include the following problems.

1. What is the nature of the feeding reactions of the infant at different age-levels within the first half year of life?
2. How does the behavior of the bottle-fed baby compare with that of the breast-fed?
3. Are there specific reactions to the bottle or breast, when do these appear, and how are they affected by hunger and satiety?
4. What relationship exists between specific feeding reactions and other behavior components, principally the child's social reactions?

In all, ten series of observations were carried out: six with bottle-fed and four with nursed babies, on 272 subjects, ranging in age from one day to six months with a total of 461 situations recorded. A survey of the data is facilitated by considering these two classes separately, bottle-feeding in Part I and nursing in Part II.

PART I

The Bottle-Fed Infants

Observations on bottle-fed babies in the ordinary feeding situation and its experimental variations were carried out in the following series.

Series I. The customary feeding situation.

Series II. Substituting a rattle for the bottle under the customary feeding conditions, as a control to the findings in Series I.

Series III. Presentation of the bottle at the feeding hour without the usual social contact and without the preliminary procedure.

Series IV. Substituting a rattle for the bottle under conditions the same as those in Series III.

Series V. Presentation of the bottle isolated from the other factors at a time when the infant was not hungry.

Series VI. Substituting a rattle for the bottle under conditions the same as those in Series V.

2. Observation of the Customary Feeding Situation

The subjects for this and the subsequent observations on the bottle were infants in the municipal children's clearing house of Vienna* where the feeding situation and procedure were as follows: The child is hungry, lying in his crib. The nurse approaches the crib, opens and shuts the door of a metal cabinet out of which she takes a clean diaper (used as a bib), and places this under the child's chin. She then places the nipple of the bottle in his mouth, and allows the bottle to rest on the cover over the child's chest. The nurse may accompany her actions with soft talking. In the course of these administrations the bottle comes into the child's line of vision only as a matter of accident, since no point is made of showing it to him. In addition to this visual stimulus, when present, the organic, the social, auditory, pressure, kinaesthetic, and temperature stimuli are components of the situation, as can be seen from its description. Since the baby's hands were usually under the covers, discriminative touch as applied to the bottle does not

* Die Kinderübernahmstelle der Gemeinde Wien.

normally occur as a stimulus specific to the feeding situation.

The observations in Series I were made in the situation just described, varied in only one significant detail. In order to permit closer study of the reactions to seeing the bottle, a point was made of bringing it into line with the child's glance, and of moving it about slowly within the field of vision before placing it in the mouth. The procedure was carried out on 60 infants, twelve at each monthly level from 0;1 to 0;6.* The reactions were carefully recorded in detail in terms of the behavior units worked out in Bühler and Hetzer's inventory of reactions for the first year (5).

Two sample protocols may be cited.

0:1 + 13. Application of the bib:
Mouth thrown wide open.
Sucking movements.
Sucks at finger and bib.
Turns head to the side.
Turns head from side to side.
Presentation of the bottle:
Does not see the bottle.
Cries.
Withdrawal of the bottle:
Eye movements not in the direction of the bottle.

0;5 + 19. Application of the bib:
Grasps examiner's hand.
Guides it to his mouth.
Presentation of the bottle:
Focusses glance on the bottle and follows its movements.
Sucking movements.
Stretches hand in the direction of the bottle.
Makes grasping movements.
Withdrawal of the bottle:
Looks after the bottle whimpering.
Stretches hand out after it.

In handling data obtained from observing reactions, the first and most obvious classification to suggest itself was the division into specific and unspecific reactions with respect to the situation under consideration. Specific reactions are defined as those which, judged objectively, are directed and purposive for the intake of nourishment, and unspecific reactions are those which cannot succeed in furthering or attaining this end. Examples of unspecific reactions are: sucking on the bib or playing with it, looking passively at the bottle while sucking

* According to the method here used for representing the exact age, the number preceding the semicolon is the number of completed years, the number following the semicolon, that of completed months, and additional days are indicated with the plus sign. E.g.: 3;2 + 7 represents an age of 3 years, 2 months, and 7 days; 0;0 + 21 an age of twenty-one days.

the fingers, and uncoordinated movements of all kinds. Specific reactions are such as opening the mouth, turning the head to the side, sucking movements, grasping movements in the direction of the bottle, attempts to put the bottle in the mouth, etc., as well as expressions of impatience or quieting down upon sight of the bottle.

3. Redintegrative Response to the Bib

The complicated feeding reaction can be viewed more readily when considered in parts. This simplification of treatment is justified and even suggested by the data. The first of these parts includes the preparatory administrations and the application of the bib.

Sucking and other feeding reactions were observed in response to the bib among the very youngest subjects. These reactions are presented in Table 1. The findings are surpris-

TABLE 1. REACTIONS TO THE APPLICATION OF THE BIB.

		0;1	*0;2*	*0;3*	*0;4*	*0;5*
No reaction		1	1	2	2	5
Unspecific reactions	Wriggling, waving arms	2	6	7	12	4
	Playing and sucking on bib or fingers	7	6	3	2	3
Total		9	12	10	14	7
Specific reactions	Opening the mouth	3	1	0	2	1
	Turning head to side	7	3	1	1	3
	Sucking movements	8	7	2	1	3
	Quieting and impatience	1	1	5	3	3
Total		19	12	8	7	10

ing in that the specific reactions to the bib diminish with age through the 5th month only to increase again at the 6th. It is evident that the quality of the specific reactions of the 6th month must differ from those manifested by the infant at the earlier age-levels. It is likely that an inquiry into the nature of this difference will explain the variation of distribution.

Judging on the basis of all other observation which can be brought to bear on this point it may be deemed impossible that a one-month baby execute lively sucking movements when the bib is applied because he expects or anticipates the bottle. True manifestations of expectancy are not observable before 0;3. Expectation may therefore furnish a possibility in ac-

counting for the rise in number of specific reactions at the 6th month, but the situation of the one month child is different. It is an interesting case of redintegrative action.

It will be recalled, a specific reaction was defined as one objectively adapted to the feeding process. Such responses include the preparation for receiving nourishment and the approach to its source as well as behavior directly serviceable in imbibing it. In classifying the reactions to the bib the same criterion is employed for specific reactions, so that the specificity of the reaction is determined by its relation not to the particular stimulus, "bib," but to the whole situation, "feeding," of which it is a part. Strictly speaking, a response would be specific with respect to the bib if it were an appropriate bit of behavior applicable to a bib, and to a bib only. (This would be exemplified in such acts as tucking a bib under one's chin, spreading it over one's shirt-front. Since this use of the word is not meant here, the difficulty of finding a response of this sort in the infant's limited repertoire need not embarrass us.)

From an objective standpoint the feeding situation is a whole. It is a unit as described above, beginning with certain fixed preliminaries, and terminating in drinking the contents of the bottle. There would seem to be a subjective unity of the feeding process, in so far as any subjective phenomenon can be assumed by an observer, beginning when the first pangs of hunger are felt, continuing through the various sensations presented by a preliminary procedure, culminating in the drinking, and ending with satiety or the cessation of hunger. Contact with the bib is a detail of this whole, and results show that it is capable of eliciting a response specific to the whole as early as the second month. The great number of specific reactions to the bib at the two early age-levels can thus be accounted for on the redintegrative basis, as effective substitution of a partial stimulus for the whole. No other factor is necessary for an explanation. An assumption of "expectation" would not only be unnecessary, but also absurd, inasmuch as no specific reactions to the bottle itself, as source of nourishment, or to the person administering it were found at this age. This will be seen when reactions to the bottle are considered, and conclusive evidence on this score will be offered then.

The specific reactions elicited by the bib are a case of a response following a detail of its former antecedent. The de-

tails of a situation vary in instigative potency (14), and it is interesting to note why the bib should be the earliest detail to release the total response. Firstly, it holds a primary position in the temporal order of objective events, giving it the advantage. Secondly, the stimulation is tactile in nature, and the sense of touch is one of the best developed at birth. It is even likely that such specific reactions occur before 0;1, and the fact that no bottle-fed subjects were obtainable below this age leaves the study of this particular point incomplete.

An investigation of the possible rôle of the sense of touch in the infant's identification of the bottle was attempted in a supplementary series of experiments on 10 subjects from 0;1+15 to 0;2+15. The interest here centered on all tactile stimuli *other* than that of the direct contact of the lips with the nipple, as the specific reaction resulting from this direct contact is entirely of a reflex nature, and would throw no light on the present problem. The usual accompanying stimuli of sight and smell were avoided by filling the bottle with water while its temperature and weight were the same as under the normal feeding conditions. The examiner avoided the child's mouth or face with the nipple, and was careful not to let the child see the bottle which was laid on his chest between the arms. The hands and arms were then placed in contact with the bottle, and full freedom and opportunity for tactile impressions were provided. However, no specific response was elicited.

This result need not contradict the importance of the sense of touch, for the lack of response may have been due to the fact that the tactile stimuli supplied by the bottle have insufficient distinctness to allow of differentiation from other tactile impressions coming from the environment generally. Again it may be that tactile contact with the bottle under customary circumstances is made when the child is already intent upon imbibing his nourishment and does not attend to other factors. Intervening clothing may also interfere with the functioning of touch in this connection.

4. Seeing the Bottle

In a consideration of the reactions to the bottle it is of primary interest to ascertain from what age on the baby *sees* the bottle. Criteria for "seeing" the bottle were considered—(1) focussing the glance on it when it was presented to the field of

vision, and—(2) appropriate movements of the glance, either in following the moving bottle or roving up and down over its surface. Table 2 shows the percentage of children at each age

TABLE 2. PERCENTAGE OF 60 SUBJECTS WHO SAW THE BOTTLE.

Month	0;1	0;2	0;3	0;4	0;5
Percentage	0	0	33	75	100

who saw or did not see the bottle. All the subjects saw the bottle after the 5th month, and the youngest to see it were in the 4th. Before this age the child pays no attention whatsoever to the bottle visually presented, in some cases even hampering appropriate contact with it. There were several cases of infants in the 3rd and 4th months whose gaze was directed so absorbedly toward the examiner that it could not be brought to light upon the bottle. The fact of the infant's general preference at this age for persons rather than for objects has been brought out in several other investigations.

5. Recognizing the Bottle

When does the child *recognize* the bottle which he begins to see at the 4th month? It was judged that a child "recognizes" the bottle if (1) he reacts to it in an appropriate manner, i.e., expedient from the point of view of taking nourishment, and (2) if he reacts that way to the bottle only and not to any other random object presented to him. When the specific

TABLE 3. REACTIONS TO SEEING THE BOTTLE.

Month	*0;1*	*0;2*	*0;3*	*0;4*	*0;5*
Unspecific reactions:					
Non-directed movements			2	3	1
Specific reactions:					
Quieting				1	
Signs of impatience			2	3	3
Sucking movements			1	1	1
Approaching the bottle					1
Directed movements				3	7
Grasping				2	3
Guiding it to the mouth					3
Sum of specific reactions	0	0	3	10	18

reactions to the bottle have been determined, the reactions to some other object must be observed as a control, since it is quite possible that the child of this age may react to the most diverse objects as if they were alike sources of nourishment.

The reactions which followed upon seeing the bottle are presented in Table 3. With the exception of the non-directed movements all the reactions are of an expedient nature. The baby who ceases his crying upon seeing the bottle, and waits for the examiner to give it to him is behaving as adequately as one who strives impatiently toward the bottle. Sucking, turning the head to the bottle, grasping it, and putting it to the mouth are, obviously, specific reactions. The increase in the number of these reactions with age is made clear by comparing the number of subjects who manifested them with the number who saw the bottle. These figures are shown in Table 4.

Not only does the number of cases manifesting these reactions increase with age; the number of the reactions themselves increase as well. Whereas the 3- to 4-months child

TABLE 4. THE NUMBER OF SUBJECTS REACTING TO THE BOTTLE.

Month	*0;1*	*0;2*	*0;3*	*0;4*	*0;5*
No. of subjects	12	12	12	12	12
No. who saw	0	0	4	9	12
No. reacting specifically	0	0	3	8	11

reacts only by sucking or signs of impatience, the 4- to 5-months child learns a whole series of reactions in the nature of actively going after and procuring the stimulus. Certain protocols bring out the gradual mastery of eye-hand coordination as involved in combining the abilities of sight and grasping. Miss Shinn (20) found that the infant she observed was able at 3 months to grasp an object, but could not carry out a visually guided grasping until the 5th month. The following excerpts from protocols show the advance from grasping at a felt object, to grasping at one seen.

0;3 + 28 It was not possible to introduce the bottle into the field of vision although the child grasped at the nipple.

0;4 + 4 The child does not see the bottle when visually presented, but during the feeding he takes the nipple out of his mouth and replaces it again, once with right and once with the left hand.

0;4 + 14 Sees the bottle, but remains passive and inactive.
During the feeding he takes the nipple out of his mouth and puts it back again.

0;5 + 12 Sees bottle.
Stretches hand toward it, grasps it, and brings it to the mouth.

Another development from passive to active behavior can be traced on the basis of the protocols and will be referred to below.

The figures in Table 4 show that specific reactions occur as elicited by the bottle from the 4th month on, or practically as soon as the visual response. This fact furnishes the information regarding the first criteria of recognition. It now remains to ascertain whether the infant at this age reserves such behavior for the bottle exclusively. It was with a view to finding this that the observations of Series III-VI were made.

6. Differences in Reactions to the Bottle and a Rattle

Differences in reactions to the bottle and a rattle were studied under conditions simpler than those involved in the customary feeding situation. In the first place, the preparatory procedure and the placing of the bib were omitted, and secondly, the social contact between subject and examiner was excluded. The examiner remained behind a screen which was placed against the crib. The observations were made through a peep-hole in the screen, and through another larger hole, opening up with a flap, the bottle or rattle was presented to the child's field of vision and within his reach. The bottle used in these series was filled with flour so that it maintained the appearance of a milk-bottle and at the same time avoided any possible odor of milk. The rattle was simple in shape, colored pale blue and while, and approximately the same size as the bottle. Its pebbles had been removed so that it was rendered silent. The object was held up to the child for 30 seconds, and the reactions to its presentation and withdrawal were carefully recorded. Each of series III to VI had 35 subjects, 5 for each half-month from 0;2+15 up to 0;6. Series III and V were carried out shortly before an actual feeding, and Series IV and VI half an hour after feeding. The influence of the organic factors of hunger and satiety will be considered later. At this point the differences in reactions to rattle and bottle will be brought out. The consideration limits itself to specific reactions as these were defined in reference to the bottle in Series I. Table I shows the comparison in the number of cases. Table 6 presents it in terms of percentage of distribution.

It will be noted that some reactions, as for example grasping and signs of pleasure or impatience, appear in response to the rattle as well as the bottle and may be considered appropriate in both cases. However, sucking movements, opening

TABLE 5. THE NUMBER OF CASES MANIFESTING SPECIFIC REACTIONS TO THE RATTLE AND BOTTLE.

Type of Reaction	*To the Bottle*				*To the Rattle*			
	0;2	0;3	0;4	0;5	0;2	0;3	0;4	0;5
Opening the mouth, sucking, turning the head	0	4	13	6	0	2	2	1
Smiling, pleased facial expression, impatience	0	2	0	9	0	1	0	4
Grasping and attempts	0	2	1	10	0	2	1	17
Feeling, playing, taking to the month	0	0	2	9	0	1	0	12
Totals	0	8	16	34	0	6	3	34

TABLE 6. PERCENTAGE DISTRIBUTION OF SPECIFIC REACTIONS TO THE RATTLE AND BOTTLE.

Reactions	*To the Bottle*	*To the Rattle*
Opening the mouth, sucking, turning head to the side	24	4
Smiling, pleased facial expression, impatience	10	5
Grasping and attempts	17	21
Feeling, playing, taking to the mouth	7	12
Sums	58	42

the mouth, turning the head to the side so that the bottle can be introduced into the mouth, are to be expected only in response to the bottle if we assume that the child distinguishes between rattle and bottle. The figures show that this distinction is actually made. There is evidence of this at 0;3, and at 0;4 it is clearly established. Opening the mouth, sucking, turning the head are elicited by the sight of the bottle and occur only rarely in response to the rattle. The bottle is likewise more frequently the cause of affective reactions shown in smiling and signs of impatience, etc. It may be noted that the two objects are grasped with equal frequency. The fact that the rattle is taken to the mouth even more often than the bottle, which was heavier and less convenient to handle, does not invalidate the conclusion that the bottle was recognized as such. The child of this age preferably examines the tactile qualities of all objects which come to his hand by placing them

in the mouth, which movement is therefore in no way an indication that he deems the object edible.

These data are evidence for the second criterion of recognition and establish the recognition of the bottle as a fact beginning at the 4th month. It is not surprising to find the infant of this age already capable of distinguishing between rattle and bottle when certain other related findings are considered.

Specific reactions have been observed in response to the human voice at 3 weeks of age (5) and to the human face at 2 months (4). A consideration and comparison of these results shows that the bottle, representing the source of nourishment of bottle-fed babies, is neither the only nor the first object which elicits specific reactions from them. In the young infant's system of responses persons take precedence over things. The bringer of nourishment is recognized and responded to before the object-source of nourishment itself.

7. Comparison of Specific Reactions to the Bib and Bottle

A comparison of the specific reactions to the bib and bottle is represented in Figure 1. The percentage of children manifesting specific reactions in Series I is shown for each age-level. As already pointed out, the number of specific reactions to the bib decreases steadily from 0;1 to 0;4, when the curve rises again.

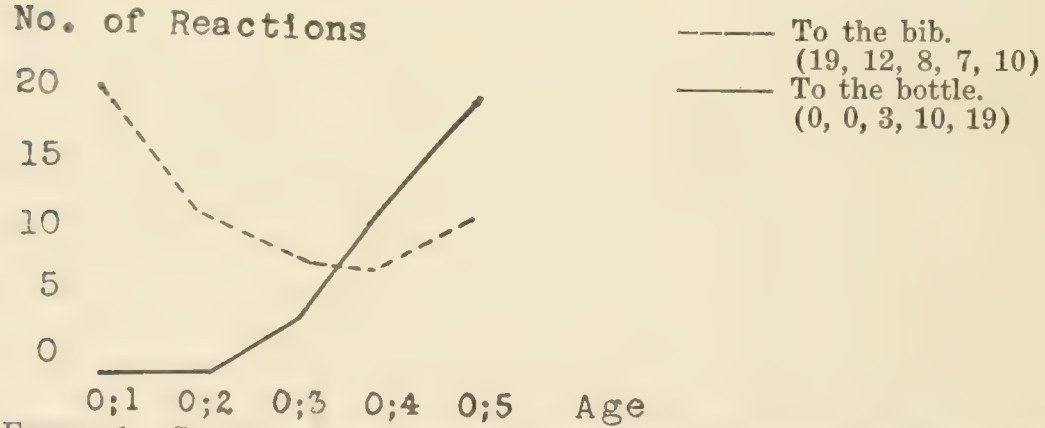

FIGURE 1. SPECIFIC REACTIONS TO THE BIB AND BOTTLE. 60 SUBJECTS.

This number does not reach the height at 0;5 which is found at 0;1. The first specific reactions to the bottle occur at 0;3 and by 0;5 they occur in 100% of the cases. The combination of data would lead one to surmise that the reactions to the bib at this later age-level may be true signs of "expecting" the bottle. This type of behavior to the bib at earlier levels, as

described above, can be accounted for on a redintegrative basis. Its subsequent falling off is probably a direct result of its lack of success in bringing about satisfaction of hunger. It will be apparent from the protocols quoted below that activity directed toward the bib in this manner hinders the progress of the feeding proper.

8. Expectancy

Expectancy is clearly evidenced where the infant's reactions prepare him in some way for the process of imbibing nourishment. Where his reactions are directed solely to the bib itself, sucking on it, or playing with it, there can be no question of preparatory activity, i.e., activity directed toward the nourishment about to come. As seen in Table 6 there is a marked decrease at the age of 0;3 of the type of behavior which, by its very nature, excludes all possibility of expectancy. The following excerpts from protocols reveal this mode of response.

0;2 + 15 Application of the bib:
Head turned toward the side, making it impossible to bring the bottle into the field of vision.
Presentation of the bottle:
Places finger in his mouth.
Difficult to replace it with the bottle.

0:3 + 18 Application of the bib:
Turns head to the side.
Sucking.
Presentation of the bottle:
Glance is fixed steadily on the bib.
Examiner moves bottle back and forth before his eyes.
No response: glance remains focussed on the bib.

TABLE 7. PERCENTAGE DISTRIBUTION OF RESPONSES CONSISTING IN ALL-ABSORBING ACTIVITY DIRECTED TO THE BIB.

Month	0;1	0;2	0;3	0;4	0;5
Percentage of 60 subjects	45	22	11	11	11

A different type of specific reaction comes to be appreciably manifested, at the age of 0;3. (See Table 1.) This is represented by the categories "quieting down" and "expressions of impatience," which differ from the other specific feeding reactions in that they are not actual feeding reactions. They are of no use in the imbibing of nourishment. As long as the infant responds to the preparatory stimulation with the same behavior as that used in responding to the essential stimulus of nourishment, or to the situation "feeding" as a whole, his reactions can be accounted for by redintegrative processes. How-

ever, where his reactions to the preliminary procedure are *not* applicable to the actual imbibing of nourishment, but are themselves of a preparatory nature, his behavior is no longer entirely explicable on the basis of redintegration. The reaction to the part is no longer the same as that to the whole. At this point, then, one may assume the working of some other factor, namely, that which has been referred to as "expectancy." It can hence be stated that the infant begins at the 4th month to expect his bottle on the basis of feeding preliminaries.

In how far the factor of imagery enters into this expectancy is beyond the scope of this investigation, and cannot be ascertained from these observations. Wislitzky (4) found some evidence of perseverative imagery from the 3rd month on, and Guernsey (10) observed retarded imitation of movement after 24 hours at the age of 0;8. In the case of the observations on feeding it should be borne in mind that the exercise of having the bottle follow upon the bib precedes the next application by three or four hours.

It is interesting in this connection to compare some findings on the "physiological recognition" of the bottle. Peiper (18) observed that the digestive glands were set into activity by the sight of the bottle at the 9th month. No such evidence could be determined for an earlier age.

9. Disappointment

The extent to which the infant expected satisfaction of his hunger is further revealed by a study of his reactions to the withdrawal of the bottle. It will be recalled that in Series I the examiner presented the bottle to the child's view, moved it about within his field of vision, and then withdrew it from his gaze. The figures in Table 8 show what percentage of the subjects reacted to this disappearance of the bottle.

TABLE 8. PERCENTAGE OF 60 SUBJECTS REACTING TO THE DISAPPEARANCE OF THE BOTTLE.

Month	0;1	0;2	0;3	0;4	0;5
Percentage	0	0	25	50	100

When an infant looked after the disappearing bottle, directed movements toward it, or showed negative affective expressions, he was considered as "reacting to the disappear-

ance." The distribution to these single reactions at the different age-levels is shown in Table 9.

TABLE 9. SPECIFIC REACTIONS TO THE WITHDRAWAL OF THE RATTLE.

Month	*0;1*	*0;2*	*0;3*	*0;4*	*0;5*
Perceptual reaction: looking after it			1	4	11
Affective reaction			3	3	7
Effective reaction: directed movements				1	6

It will be seen that the first reactions are manifested at 0;3. Where expectancy is present one would look also for evidences of disappointment if the course of feeding is hindered. The figures bear out this assumption.

The negative affective reaction is the most frequent of the three reaction-types at 0;3. Actively reaching after the bottle is only possible at 0;4 and 0;5. A similar turning point from passive to active behavior was found in response to the presentation of the bottle. This transition from looking to grasping is shown in Figure 2. The data are taken from Series III-VI including both rattle and bottle, plus a supplementary series of 20 observations on 5 subjects aged 0;6.

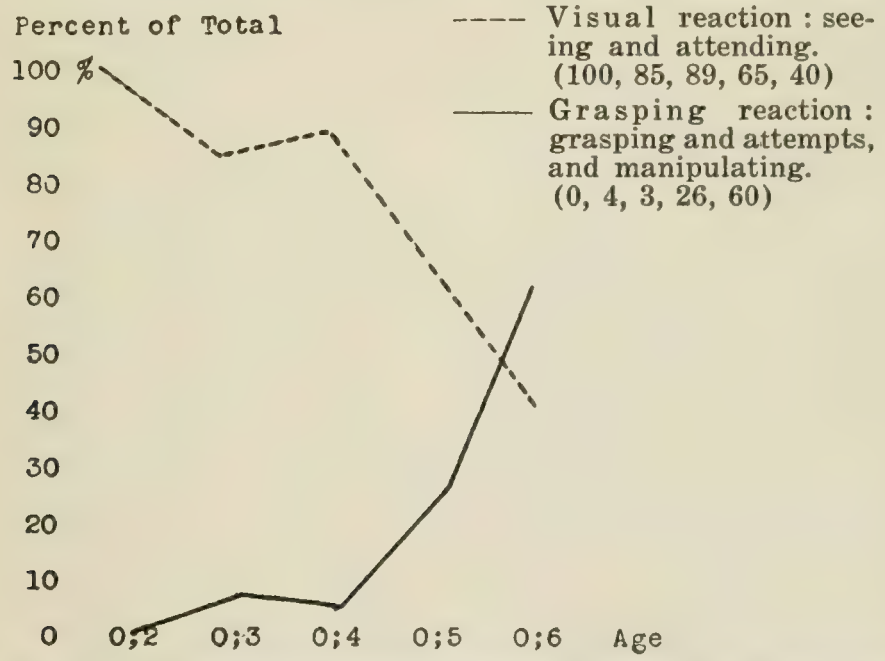

FIGURE 2. COMPARATIVE FREQUENCY OF VISUAL AND GRASPING REACTIONS.
The Percentages are Based on the Total Number of Reactions for the Age-level for Rattle and Bottle.

In Series II the procedure was to substitute a rattle for the bottle in the otherwise similar feeding situation. The sub-

jects numbered 30, 10 each for the 4th, 5th, and 6th months. The general purpose of this series was to furnish control material for Series I, and the control can be applied in particular to the findings on expectation. As stated above, it is a natural assumption that a child manifesting expectancy when the bib is applied will show signs of disappointment if his expectations are not realized. On the other hand, if the infant's response is undifferentiated, the same for the bib as for the whole situation, he is not likely to be greatly moved by the presentation of a rattle in place of a bottle. Reactions in this series termed "disappointment" were the following: negative affective response to the rattle, attempts to push the rattle away, and the cessation of preparatory feeding reactions. These disappointment responses begin at 0;3, double at 0;4, and increase still further at 0;5. The positive affective responses elicited by the rattle in this series begin at 0;3, become more than doubled at 0;4, but show their lowest frequency at 0;5. A comparison of these two sets of figures is given in Table 10.

TABLE 10. THE PERCENTAGE DISTRIBUTION OF POSITIVE AND NEGATIVE AFFECTIVE RESPONSES TO THE RATTLE IN SERIES II. (35 SUBJECTS.)

Month	*0;3*	*0;4*	*0;5*
Percentage of positive responses	25	63	12
Percentage of negative responses	16	32	52

The increase in positive reactions at the 5th month is to be explained on the basis of general developmental factors at this age and corresponds to Beaumont's findings (11) with respect to the spontaneous interest in visual stimuli. The decline of positive responses beyond this point and the corresponding increase of the negative gives indirect evidence of expectancy which was unfulfilled. The figures point to the beginnings of disappointment in the 4th month and its further establishment in the 5th and 6th.

10. Simple and Complex Situations

The data obtained in these series of experiments furnish an interesting comparison of responses to situations relatively simple and complex. It is of course impossible for a reaction ever to occur in response to any one isolated stimulus. The objective and overt stimuli can, however, be controlled; they can be lessened or added to by the experimenter, so that one

may justifiably assume greater or lesser "wholes" of experience, corresponding to the more simple or complex situations.

It was found that responses to given details are elicited at an earlier age when these are separated from their context and presented in comparative isolation. This will be made clear in the following exposition.

In Series I the bottle was presented to the child in the usual complex of successive and accompanying stimuli. In Series III and V the bottle was shown apart from the usual elements of the whole situation, in so far as this was possible under experimental conditions. The percentage of infants seeing the bottle in the "isolated" and "complex" situations is given in Table 11. (The figures are not absolutely comparable, as the "isolated" percentages are based on 20 cases for each month and the "complex" on 12.)

TABLE 11. PERCENTAGE OF SUBJECTS WHO SAW THE BOTTLE.

Month	*0;1*	*0;2*	*0;3*	*0;4*	*0;5*
"Isolated" bottle (20 cases per month)	—	60	70	100	100
Bottle in feeding situation (12 cases per month)	0	0	33	75	100

The figures show a decided and perhaps surprising difference in favor of the simpler situation. At 0;2, where no visual response is elicited from the infant in the feeding situation, it is manifested in more than half of the cases of the same age when the bottle is shown from behind a screen. At 0;4 visual responses are elicited from all 20 infants to whom it is shown in "isolation," but from only 9 out of 12 who see it before feeding. Visual stimuli, at any rate, are more potent at this age when singly presented than when presented as a part of a context. Not until 0;5 is the same behavior observed in response to the stimulus of the bottle regardless of its context.

Similar results were found when the rattle was used as a stimulus. Series IV and VI supplied data for the relatively simple situation, and Series II for the complex. The comparison of findings appears in Table 12, expressed in the percentage of subjects at each month who saw the rattle.

TABLE 12. PERCENTAGE OF SUBJECTS WHO SAW THE RATTLE.

Month	*0;2*	*0;3*	*0;4*	*0;5*
"Isolated" rattle (20 cases per month)	70	75	100	100
Rattle in feeding situation (10 cases per month)	0	30	70	80

These comparisons deal with reactions of a sensory and perceptual nature. The results with regard to affective responses are different. In the first place, the affective responses are more frequent in the complex situation than when either bottle or rattle is isolated. This is shown in Table 13.

TABLE 13. PERCENTAGE OF SUBJECTS MANIFESTING AFFECTIVE RESPONSES.

Situation	*Simple*	*Complex*
To the rattle	7	17
To the bottle	16	24

Throughout these observations the affective responses have been classified as negative and positive. The former include lowering the corners of the mouth, whimpering, crying, turning the head away, pushing the stimulus away. The positive category includes positive facial expressions, active approach, and direction of attention to the stimulus. The percentage of subjects who reacted negatively and positively in Series I and II, i.e., to the bottle and rattle in the feeding context, and Series III-VI, to the bottle and rattle as "isolated" stimuli are given in Table 14.

The factors determining the affective quality as well as quantity of the response must be laid largely to the working of the complex situation as shown by a comparison of the "isolated" and "complex" observations. Not only do the affective responses to isolated stimuli number fewer, but the affective differentiation between rattle and bottle is considerably lessened.

TABLE 14. PERCENTAGE OF SUBJECTS REACTING NEGATIVELY AND POSITIVELY IN COMPLEX SITUATIONS.

Series I and II.

Tone of the Reaction	*Negative*	*Positive*
To the rattle (30 subjects)	33	10
To the bottle (60 subjects)	3	60

TABLE 15. PERCENTAGE OF SUBJECTS REACTING NEGATIVELY AND POSITIVELY IN SIMPLE SITUATIONS.

Series III-VI.

Tone of the Reaction	*Negative*	*Positive*
To the rattle (35 subjects)	0	7
To the bottle (35 subjects)	3	13

This comparison may not be altogether fair, in so far as the relation of the rattle to the feeding context is artificial and particularly provocative of emotion. However, it is interesting to note that whereas only 13% of the subjects reacted positively to the bottle as an object by itself, 60% did so when they perceived it in the feeding situation.

11. The Influence of Hunger

As previously mentioned, Series III and V presented the bottle and rattle respectively to the infant just before feeding time, when a strong degree of hunger was assumed. Series IV and VI presented the bottle and rattle half an hour after feeding, presupposing an organic state of satiety or lack of hunger. With the exception of this organic variable all other factors were constant, so that the differences in behavior observed may be attributed to the effects of hunger.

So much has been said about "the hungry animal," and "the hungry child" for that matter, too, that expectations for the findings along these lines appear commonplace. However, so far as the present writer knows, there are no quantitative data on the behavior of infants before and after feeding. In view of the present knowledge and appreciation of the dynamics of hunger, one should expect more activity generally in the hungry state, and more in connection with feeding reactions in particular. In other words, the hungry infant should recognize the bottle, show affective responses to it and its withdrawal, more than a child whose organic set is not directed toward nourishment. The records of Series III to VI show 14 cases of active approach to the bottle on the part of hungry subjects as against 10 for non-hungry subjects. There were 25 specific and affective reactions for hungry subjects as compared with 15 for the non-hungry. Table 16 presents the figures with regard to recognition of the bottle. The data are interesting in that they show a slight advantage in favor of the non-hungry subjects at 0;3, whereas after 0;4 this is increasingly with the hungry.

TABLE 16. THE NUMBER OF SUBJECTS, HUNGRY AND NON-HUNGRY, WHO RECOGNIZED THE BOTTLE.

Month	*0;2*	*0;3*	*0;4*	*0;5*	*Average*
Hungry subjects (35)	0	2	7	8	5.7
Non-hungry subjects (35)	0	3	5	4	4.0

Though the chances of the hungry child's recognition of the bottle are appreciably greater (varying with age), still, the effects of hunger as a motivating force are far from being uniform.

There is another group of data which contributes to a study of the effects of hunger and corroborates this point. The reader is reminded that Series III-VI were conducted according to the following procedure. The object of presentation, rattle or bottle as the case might be, was introduced through a hole in the screen and exposed to the subject for 30 seconds and the reaction carefully noted. It was then withdrawn and the subject's reaction to the withdrawal was timed and recorded. The reactions fell into the three groups of the perceptual, affective, and effective, including a passive looking after the object, perseverated staring at the place in the screen through which it disappeared, expressions of affective tone, and reaching after the object. A comparison of the duration of the reactions to the withdrawal in the hungry and non-hungry states is presented in Table 17. The average time has been calculated for each month.

TABLE 17. DURATION OF REACTION TO WITHDRAWAL OF THE BOTTLE, IN SECONDS.

35 Subjects.

Month	*0;2*	*0;3*	*0;4*	*0;5*	*Average*
Hungry	5	25	73	74	43
Non-hungry	21	34	48	34	31

Here again the turning point in favor of hunger occurs at the age 0;4. Below this age the hungry child's response is shorter than that of the satiated child; at this age and beyond the reverse is true.

These findings show that hunger may exert an inhibitory influence on certain responses—in this case, on feeding reactions. To speak metaphorically, it would seem as though the infant younger than 0;4 is overpowered by the organic condition of hunger. As in all kinds of power, the force itself has only potential serviceability and must first be harnessed and directed before its services may become realized. The reactions observed in this study were of the learned sort. Had they been instinctive feeding reactions it is more than likely that the presence and increase of hunger would have been ac-

companied by an increase of appropriate reactions. Not until the infant has learned to master well a repertoire of reactions capable of procuring satisfaction does the presence of hunger aid it in effecting these reactions. It is not until the age 0;4 that hunger begins to "motivate" learned feeding reactions in the sense that its presence increases the number and efficiency of reactions directed toward its satisfaction.

12. Summary

1 As early as the first month specific reactions are elicited by a detail of the whole feeding situation, namely, by the stimulation involved in applying the bib.

2. Tactile stimulation presented by the bottle elicited no such response at this age.

3. Infants begin to see the bottle presented to them at the fourth month.

4. Infants begin to recognize the bottle, i.e., to react specifically to its visual presentation, at the fourth month. At this age the bottle is recognized almost to the same extent as it is seen.

5. The bottle has no advantage over other visual stimuli by virtue of being the source of nourishment. A rattle elicited visual and specific reactions equally as early and equally as frequently as the bottle.

6. Specific reactions to persons occur earlier than to the bottle. The giver of nourishment takes precedence over the object of nourishment itself.

7. Infants begin to expect the bottle on the basis of preliminary feeding procedure at the fourth month.

8. Disappointment is evidenced in response to failure to present the bottle or to its withdrawal from the fourth month on.

9. The feeding reactions of hungry and non-hungry infants show a difference, though this is not of a constant nature. Before the fifth month hunger was observed to hinder specific responses, after the fifth month to promote them.

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PART II

The Nursed Infants

12. Feeding Reactions During the First Week of Life

As common experience has shown, the behavior of new-born infants differs widely in their first contact with the mother's breast. Some are remarkably equal to the occasion and drink skillfully from the beginning. Others must be coaxed and forced to make the adaptation demanded of them to partake of nourishment. Many can barely be kept awake the length of time necessary for a sufficient feeding.

There is a great difference of opinion as to just what reactions the neonate is capable of executing and as to the degree of his helplessness. This variance may be due to individual differences on the part of the infants or to an insufficient number of cases on the part of the observers. At any rate it is agreed that every neonate is capable of making sucking and, with rare exceptions, swallowing movements. These reactions have been observed even in cases of individuals born without a cerebrum, which fact vouches for the very primitive and reflex character of the response. There is evidence that drinking is practiced by the embryo in utero.

Canestrini (8) has pointed to the distinction between the purely reflex simple sucking movement, and the sucking proper, functioning in the service of the nourishing instinct. The reflex sucking movement occurs in response to any contact with the lips. According to some observers, it may be elicited by stimulating other organs of the body. It also appears apparently unprovoked by external causation. The expedience of this reflex sucking, as pointed out by Mursell (17), lies in the possibility of continuous oral experimentation which it furnishes. Sucking proper is composed of several reactions, in part of a very complicated nature. In addition to the reflex sucking movement and swallowing, taking hold of the mammilla and the necessary muscular exertion are involved. The observations of Series VII, to be described below, bring out the way in which this sucking proper becomes combined with reactions of spacial orientation and approach to form the nursing technique. Canestrini corroborates Harvey's claim that new-born infants forget the art of drinking within a few days

if unable to practice it. Children who are temporarily fed with the bottle and then returned to the breast show signs of having very soon forgotten how to nurse. Solliez (8) made some observations on congenital idiots which pointed to the influence of learning ability and memory on the greater or lesser skill in this connection. New-born aments were found to present great difficulties in nursing and it was barely and only very slowly that their behavior became more adequate with experience. Solliez says: "every time they are given the breast, it appears to them as something new, and each new experience fails to become linked up with the foregoing."

As preliminary to a study of the feeding reactions of nursed infants, 5 neonates were observed the first time they were given their mothers' breast. The children were 24 hours old at the time of this, their first feeding. They were babies with histories of healthy gestation, of normal weight, whose birth had been without complications of any kind. Even before the babies had been given the breast, sucking movements were observed either as elicited by a chance contact of the hands on the mouth or as spontaneous movements occurring at intervals between periods of crying.

Protocols on the first feedings read as follows:

Child K. Is sucking his finger when brought into the nursing position.
Mother removes finger.
Places mammilla in the mouth.
K sucks and drinks straight away.
(During the course of the feeding loses mammilla several times.)

Child G. Sucks his finger when brought into nursing position.
Finger is removed.
Cries.
Drinks very slowly.
Sucking movements barely observable.

Child W. Cries when brought into the nursing position.
Mouth held tight shut.
Yawns, thereby opening mouth.
Mammilla introduced into mouth.
Slight sucking.
Cessation.
Weak sucking movements.
Regular drinking.

Child B. Upon contact with the breast, screws up nose and entire face.
Head pushed backwards.
Sucks.
Loses hold of the mammilla.
Mother replaces it.
(This is repeated several times.)

Mammilla is in the mouth; B places hand against the breast and pushes himself away.
Licks at the breast.
Whimpering sounds and facial expression.
Turns head from side to side.
Sucks—and stops.
Rapid back and forth sideways movement of head.
Drinks—and loses mammilla again.
Sucking follows each time upon the back and forth sideways movement. (Duration: 2 minutes.)

From these protocols it may be seen that the course of the feeding process in the beginning is not nearly as smooth as might be desired for the good of the child. Even those who suck lustily at first contact lose their hold on the mammilla several times or else cease sucking before obtaining the proper amount of nourishment. In no case was there any evidence of the infant's taking an active part in the process beyond sucking and swallowing, such as bringing the head closer, or holding the mouth open in an accessible position. An inventory of reactions shows only sucking movements, sucking on the mammilla, its modified form of licking, and the reflex-like rapid back and forth sideways movement made with the head. Avoiding reactions to the breast are as scarce during the first few days as is active approach. Losing hold of the mammilla is, of course, accidental and due to lack of skill. Nothing in the nature of a flight response was observed.

In order to determine at what point the infant becomes capable of modifying his reactions through experience two of these neonates were observed, during 14 feedings in addition to the initial nursing within the first week of life. The following protocols taken from subject L show how the reactions of the infant vary from one feeding to the next. Each newly observed reaction is noted in italics.

1st day. 1st feeding. 2 P.M. Mouth is open.
Mammilla introduced.
Licks.
Sucks.
Swallows once.
Cries.
Loses mammilla.
Mother replaces it.
Loses it again.
Yawns.
Whimpering, facial expression and sounds.
Crying, turning head about, etc.
(First drinking occurs after 15 minutes of the above behavior.)

2nd feeding.	5 P.M.	Sleeps. Mother shakes him. Opens eyes and shuts them again. Cries. Mouth half opened. Mother tries to introduce the mammilla. Mouth not open wide enough. Turns head away and back to the breast again. Repeated shaking and crying. Puts hand between his face and the breast. *After losing mammilla makes several weak sucking movements.* Whimpering sounds. Mammilla is placed wholly inside the mouth. Does not suck. Falls asleep with mouth closed. Hand gets in the way again. First actual sucking after 22 minutes of this. Stops again.
3rd feeding.	8 P.M.	Wakes up and opens eyes. Turns head away from the breast. *Back and forth movement of the head.* Mammilla placed in the mouth. Loses it. .....** Mouth closed. Opens eyes and mouth. ..... Is shaken and cries. Whimpers. No reaction to mammilla. ..... First drinking occurs after 7 minutes.
2nd day.	11 A.M.	*Opens and closes mouth.* Sticks hand in mouth. *Moves head from side to side while mammilla is being introduced.* Loses it. *Opens mouth* and it is reinstated. Eyes are closed. No reaction to mammilla three times. ..... Drinks after 5 minutes. Loses breast again, etc., etc.
	2 P.M.	Eyes and mouth wide open. *While lying in mother's lap, turns head toward her, stretching neck and head.* Moves hand. Whimpering. ..... Head back and forth in response to contact with the breast. Head back and forth while mammilla is being introduced. *Drinks straight away.* Clenches fists.

** ..... denotes lapse of time in which no reactions were observed.

3rd day.	11 A.M.	Stretches head forward. The back and forth movement in response to contact with breast. Given the mammilla, loses it. *Opens mouth and moves head from side to side as if to recapture it.* Turns head with mouth open to the breast. Sucks slowly. Loses it again. Puts hand between mouth and breast. . . . . . . *Turns head away—losing mammilla thereby—and turns it back again.* . . . . . . Loses it several times again. Places hand with spread fingers on face.
4th day.	11 A.M.	(Crying.) *Quiets himself directly when brought into the nursing position.* Turns head toward the breast. Mouth open; sucking movements. Mammilla presented; drinks straight away. Loses it. Opens mouth wide.
5th day.	11 A.M.	Gaze turned to mother's face. Opens mouth wide. *Lies quietly with mouth held open.* Given the mammilla. *Stretches hand out.* *Lays hand on mother's hand.* Loses mammilla. Stretches head in direction of breast. Wriggling movements.
6th day.		The protocol is essentially like that of the 5th day.

13. Learning

Many of the reactions occurring as new additions to the infant's repertoire from one feeding to the next are probably the direct result of physical development. Maturation of skeletal, muscular, and nervous elements undoubtedly account for some of these activities. They consist of spontaneous movements rather than adjustive, reactive behavior. Hence not all the action increments noted can be termed improvements, nor can they be pronounced, off hand, results of the infant's learning.

Modifications in behavior brought about by associations of movements with success or lack of it do, however, occur at early stages. The evidences of learning found in these experiments fall into two classifications. The first has to do with the responses made, the second with the stimuli which elicit them.

One might say that the infant learns *how* to react and *when* to react. In learning how to react he acquires skill. He becomes capable of making neat adjustments to the source of nourishment, taking the mammilla between his lips, sucking and swallowing nicely, and drinking without interruption until a sufficient quantity of nourishment has been imbibed. This, however, is not all that he learns. The best skill of this sort is of no avail except when the specific feeding stimulus is applied to his lips. In some way the other elements of the situation connected in space and time with the specific stimulus must acquire the potency of evoking feeding reactions so that the infant may make the grosser adjustments of preparing for the feeding, of seeking out the source of nourishment, and availing himself of it independently.

Learning as it applies to the reaction and the acquisition of skill will be taken up first and thereafter learning as it applies to the stimuli eliciting these reactions.

14. Specific Feeding Reactions

In spite of the progress noted in an intensive observation of consecutive feedings from day to day, the one-week-old infant is still very clumsy at nursing. He is constantly hindering the process by pressing his mouth tight shut, sucking his finger, restlessly turning his head away, frequently ceasing his sucking, or falling asleep during the feeding. The fact that the child himself hinders his satiation even in cases where he gave evidence of hunger by crying lustily before nursing-time, shows that hunger and feeding reactions are at this age not associated in any effective manner.

In the case of the neonate sucking was the only specific feeding reaction to be observed, i.e., the only reaction adapted to the situation. There are, however, degrees of specificity, and the sucking of the neonate is not to be compared in this respect with that of the 5-months child, in whose case sucking is elicited by the sight of the bottle and by the bottle only. Sucking at 5 months is a reaction exclusively characteristic of the feeding situation. As already mentioned, the neonate executes sucking movements even before contact with the breast. Furthermore, in his early days sucking may be observed in the most varied situations. The question then presents itself, how to differentiate, in those cases where the behavior is appro-

priate, between sucking as a general reaction or spontaneous movement and sucking as a strictly specific reaction?

The answer to this question may be found by compiling certain observations already at hand. In the series of experiments with bottle-fed children, sucking was elicited by contact with the bib previous to actual feeding at the *second month.* Charlotte Bühler's and Hildegard Hetzer's inventory of behavior (5) shows that the typical hunger cry is characterized, from the *second month* on, by interruptions of intensive sucking movements. Spielmann (6) conducted experiments in which he placed a diaper over the infant's face in order to observe the aggressive response to an annoying stimulus. Results for the first month include sucking among many other reactions, but in the *second month* sucking no longer occurs. These various findings lead to the assumption that sucking has become a specific reaction to feeding and its associations by the second month.

Sucking is not the only specific feeding reaction. In order to determine what the others might be, observations were made on 60 subjects ranging in age from 0;0 + 10 to 0;3, 10 to each half monthly age-group. The situation for this Series VII was the normal, everyday nursing procedure. It included the following elements: the mother takes the child out of his crib; she diapers him; she weighs him on the scales; holding him on her arm she seats herself on a low stool; she then bares her breast and places the infant in the nursing position.

Even at this age the infant often stands in the way of his own satisfaction. He presents such difficulties as sucking his finger and refusing to give it up, keeping his mouth open instead of closing it over the mammilla, ceasing to suck of a sudden, interspersed vocalizations, and the like. At the end of the second month interruptions due to social causes may be observed, such as returning the mother's smile. The general advance, however, is in the direction of ever lessening interruptions. This may be seen in Table 18. The interruptions enumerated therein include as causes: poor hold on the mammilla, cessation of drinking, turning the head away, falling asleep. From the second month on, the nursing periods proceed usually without interruption. In the 4th month and later it sometimes happens that a sensory interest temporarily takes precedence over the drinking, when, e.g., the child turns

his head away so that his glance may light on the experimenter or some other object.

TABLE 18. THE PERCENTAGE OF SUBJECTS WHOSE NURSING PERIODS WERE INTERRUPTED.

The first nursing at the age of 24 hours	100
Between the ages of 2 and 10 days	69
From 10 days to the end of the first month	23

Reactions which promote and smooth the course of the feeding increase with age in the same proportion as those hindering it decrease. The earliest of these adaptive responses are turning the head in the direction of the breast and the specific

TABLE 19. REACTIONS TO THE NURSING SITUATION AS OBSERVED IN SERIES VII.

(60 Subjects.)

	0;0 + 15	*—0;1*	*—1 + 15*	*—0;2*	*—2 + 15*	*—0;3*
Inadequate:						
Sticking finger in mouth	3	1	1		1	
Opening mouth	2	2	2		2	3
Holding mouth open	1	6	4	7	4	1
Sucking movements	4	3	5	6	4	2
Negative expressions and sounds	2	1	3			2
Hands and feet in the air		1		1	2	4
Stretching hand to breast			1	1		3
Adequate:						
Turning head to breast	6	7	8	9	10	10
Reaction to touch	2	3	3	2		
Reception of mammilla		1	1	1	2	
Quieting		1	1	1	3	2
Seeking with the mouth		2	2		1	
Taking hold of mammilla			4	6	8	10

response to tactile contact on the face. The last mentioned should be considered in connection with the back and forth side-ways movement of the head found in the protocols of the neonates. It is a reflex movement of great significance. Just as the reflexes of sucking and swallowing provide for the reception and intake of nourishment, this turning of the head and bringing the mouth in contact with the stimulus provides

the infant with a way of seeking out and procuring his nourishment. Procuring an edible stimulus and imbibing it are the two factors essential to the individual's ability to maintain his existence.

Observations in this series showed that a touch on the lips or cheek elicits a restless turning of the head from side to side, usually terminating in enclosing the source of stimulation in the mouth. The movement is recorded by several other observers. Preyer (19) speaks of this reaction in terms of a peculiar wagging head movement. Bechterew (1) describes it as "the first orientation in feeding, evidenced by sideward movements of the head with the mouth open or 'seeking.'" When these movements are spontaneous and apparently non-directed they seem comparable to the "trial movements" observed by Jennings (15). Kussmaul (16) elicited a response from new-born infants by stroking their cheeks with his finger. They turned their heads toward the finger and sucked on it without having experienced a direct contact on the lips. This reaction was specially in evidence in the case of lively subjects who were particularly awake and excited due to hunger and thirst. Watson (25) conducted the same experiment with similar results. Blanton (2) found this reaction easy to elicit during hunger, but hard after feeding.

This movement of the head can be best understood when considered in connection with the sense of touch in general. The very slightest stimulation, failing to evoke a response from other parts of the body, will do so when placed in contact with the lips. In addition to the great degree of sensitivity there is a certain quality of "touch-hunger" manifested about this region. Shinn (20) points to the fact that the mouth demands tactile and muscular sensation during the first months, as the eye demands the light, and explains this on the basis of the phylogenetic age and the importance of fine touch and motor sensitivity at the entrance of the digestive tract. Karl Bühler (7) carries the eye-mouth analogy further by comparing the movement which carries the mouth to the source of touch-contact with that which brings the point of clearest vision to focus on the stimulus presented to the periphery of the visual field. In other words, the reflex turning of the head and mouth is a means of bringing the point of finest sensibility into contact with the tactile stimulus. The stimulus must be of a specialized nature,—apparently a simple, light

pressure over a small surface-area, since some observers have reported failure to react to the touch of the breast, and failures of this nature were found in Series VIII as late as the end of the first month.

It is a general observation of genetic studies that trial movements originally non-purposive develop into and come to be replaced by definite, directed movements. A particular case is furnished by the development of feeding reactions. The original back and forth sideward head movement develops into the directed turning of the head toward the breast and the seeking movements of the head and mouth which appear at the end of the first month in response to being placed in the nursing position. At 6 weeks the infant takes hold of the mammilla between his lips surely and firmly when it is brought in the neighborhood of his mouth, and is able to regain it after he has lost his hold. Infants who had been crying were observed to quiet down when brought into the nursing position from the middle of the first month on. At this early age it is likely, however, that this is no specific feeding reaction, but rather a response attributable to the change in position and warmth. To sum up the specific feeding reactions observed in this group of nursed infants they are the following: sucking, turning the head toward the breast, specific response to touch on the face, seeking with the mouth, grasping the mammilla between the lips, and a type of quiet behavior favorable to the course of nursing. The percentage of subjects who manifested such specific reactions is given in Table 20.

TABLE 20. THE PERCENTAGE OF NURSED INFANTS WHOSE BEHAVIOR INCLUDED SPECIFIC REACTIONS.

(60 Subjects.)

Age	*In Days*			*In Months*	
	3-9	10-15	16.30	0;1	0:2
Percentage of subjects	13	60	70	85	100

The successful feeding reaction is that of independently taking hold of the mammilla. This had its earliest occurrence during the first half of the second month in the case of 4 infants out of 10. From this age on the percentage increases until it includes all the subjects between 0;2+15 and 0;3. These figures are given in Table 21.

15. The Cue Stimulus

It is obvious from a study of the specific reactions and the ages at which they first occur that the number of single effective stimuli increases. Not only does the child respond to more

TABLE 21. PERCENTAGE OF SUBJECTS REACTING SUCCESSFULLY.

Age	*0;1 — 0;1 + 15*	*0;1 + 15 — 0;2*	*0;2 — 0;2 + 15*	*0;2 + 15 — 0;3*
Percentage of 60 subjects	40	60	80	100

particular details of the situation. It is also characteristic of his learning that he responds with feeding reactions to ever lesser details of the whole. Whereas in the beginning the whole successive process of nursing preliminaries plus the actual contact with the breast is necessary to set off the nursing response, the preliminaries alone or some part of them are later sufficient. Again a redintegrative process is involved, in that some "detail becomes effective in the place of the antecedent context of which it had been a constituent but partial feature." (13) In other words, "a cue acquires instigative potency." (13) The problem in these experiments, then, was to determine which of the many elements involved in the complex nursing situation furnished the infant with the *cue* for his specific response.

With the exception of the response elicited by touching the lips or cheek, it is difficult to observe just what stimulus it is that sets off any one of the specific reactions. The nursing situation offers a wealth of stimulation from which practically no sense is omitted. Some senses, however, play more of a rôle than others. It is evident that sight may be discounted at this early age. Results on the bottle-fed group of subjects showed that there are no responses, even of a perceptual nature, to visual stimuli in this connection before the fourth month.

Inasmuch as the feeding reactions are among the earliest and most primitive, it is not unreasonable to assume with Stern (21) and others that the sense of smell plays an important part in the formation of a redintegrative pattern. The basis for this assumption may be found in some animal experiments. Canestrini (8) cites a case where the olfactory lobes were removed from a litter of young puppies. Those who survived the operation and recovered from it would have died of

starvation had not the teats of the mother dog been placed in their mouths. They were rendered completely helpless in this respect whereas before the operation they had been able to locate and adjust to the source of nourishment independently.

In order to investigate just what rôle the sense of smell might play in the development of feeding responses in human infants, the following experimental procedure was planned. The particular problem to be answered was: does the infant react specifically to the odor of his mother's milk? To test this the child was allowed to lie on his back in the crib, awake, the mother, with her breast bared and some drops of milk exposed on it, bent over him as closely as possible without at the same time making any contact with him. This was tried on 10 subjects ranging in age from 2 weeks to 3 months. In no case could any specific reactions be observed.

The situation was slightly altered and carried out likewise on 10 infants within these ages. The children were placed in the mother's lap in the nursing position. After a few minutes of nursing the mother withdrew the breast and covered it up. A piece of cloth saturated in mother's milk was then brought close to the child's nose and mouth, again without coming into actual contact. Restless movements and vocalizations of a negative tone were observed, obviously as reactions to the cessation of nursing, but in no instance were any movements of the head or mouth directed toward the milk-soaked cloth. This is a reaction which might justly be expected of an infant at this age were there any olfactory identification involved.

From these experiments it may be concluded that, unlike the suckling puppy, the human infant makes no observable use of the sense of smell in guiding and developing feeding reactions. The sense of smell generally has been found relatively undeveloped in the infant. Canestrini's (8) research on the sensibilities of the neonate show reactivity to smells to be very meager. Whereas he observed overt responses to strong odors, and was able to measure reactions to them in the change of breathing and pulse rates, he was unable to observe or measure any reactions to the olfactory stimulus of luke-warm, mother's milk. Similar conclusions were found by Bechterew.

These findings exclude smell as a possibility for eliciting specific reactions, in so far as neither sensory nor feeding

responses could be observed in connection with the olfactory stimulus of the nursing situation.

16. The Rôle of the Mother in the Nursing Response

Before proceeding further in the investigation of the "cue stimulus" it might be well to consider just what rôle the mother plays in the nursing situation by her presence and actions. It is interesting to compare the number of children reacting specifically in the nursed and the weaned group.

TABLE 21. PERCENTAGE OF SUBJECTS REACTING SPECIFICALLY. 60 Subjects in Each Group.

Age	*0;0 + 10 — 0;1*	*0;1 — 0;2*	*0;2 — 0;3*
To the breast	65	85	100
To the bib	—	75	83

The figures for specific responses to the breast and to the bib are given in Table 21. The comparison shows that specific reactions to the breast are more frequent at each age-level than those to the bib. Several reasons suggest themselves as accountable for the difference. In the first place, many more tactile stimuli are given in nursing from the breast, and such stimuli, as seen above, are generally favored at this stage of development. Secondly, there is a whole series of postural changes involved in nursing:—being lifted out of the crib, placed on the scales, held on the arm, and finally being set into the distinctive nursing position. The bottle-fed baby, on the other hand, remains lying on his back throughout the preparation for feeding and its consummation. A final and most important point of difference is that *two* individuals are involved in nursing from the breast: not the infant alone, as in the case of the weaned baby, but the infant and mother. Their division of labor varies with the age of the child. In the beginning the mother is the active partner in the process, and the child almost completely passive. As he grows older, the child takes over more and more of the activity to himself by preparing to receive the nourishment and by independently seeking and obtaining it. The nursing situation furnishes an ideal example of cooperative behavior, of mutual determination of activity. On this very account it is exceedingly difficult to observe just how many of the child's reactions are the result of his own activity and how many the result of some

non-apparent guiding movement of the mother. Often she herself is unaware of such movements, making it particularly difficult to isolate her rôle. The resistance offered, quite naturally, by the mothers to any irregularities in the course of the nursing period added to this difficulty.

The following procedure was employed in Series VIII on 30 subjects, ranging in age from 10 days to 3 months. The infant was interrupted in his nursing after drinking one minute. (The usual length of the nursing period was 10 minutes.) The mother withdrew the mammilla from the child's mouth and held her breast at a distance though still well within his reach. The interruption was executed at the beginning of the nursing period because the child's hunger might assumedly still be reckoned with, insuring an interest in further drinking. In spite of the interruption the infant remained lying in the characteristic nursing position. Preliminary experimenting had proven the impossibility of obtaining the position without actually giving the child the breast. This led to the adoption of the interrupted procedure, as it was of particular interest to keep the factor of posture constant. The only condition varied in this situation, then, was that of the mother's help, which was excluded.

To what extent the mother's activity does influence the child's observable feeding reactions is shown by a comparison of the specific reactions found in the normal nursing procedure when the child is given the breast with the number of specific reactions in the interrupted situation when he attempts to regain the mammilla independently. Table 22 gives

TABLE 22. PERCENTAGE OF SUBJECTS REACTING SUCCESSFULLY.

Age	*0;0-10*	*0;1*	*0;2*
After interruption (30 subjects)	0	20	40
Normal nursing procedure (60 subjects)	0	50	90

the percentage of cases in which subjects manifested successful responses in both situations. (A successful reaction is one resulting in introducing the mammilla between the lips, by the infant's independent efforts.) There are more than twice as many cases of successful reaction in the situation where the mother normally aids the child than after the interruption, where she made conscious efforts not to. In this connection it might also be stated that there were no cases of failure to

react in the natural situation; i.e., some reaction always took place when the infant was presented the breast by the mother, whether the reaction was adequate, successful, or otherwise. In the interrupted situation, however, 50% of the subjects in the first month, and 10% of those in the second, failed to show any reaction, any movement which might be objectively judged as directed to the nourishing stimulus. In some cases the subjects lay quite motionless.

If one compares the results of Series VIII, which eliminated the mother's aid, with the bottle-fed babies, the nursed subjects still show an advance over the weaned of the same age. Table 23 gives the percentage of subjects reacting specifically to the breast after drinking and to the bib before being given the bottle. The situations themselves are more nearly equal

TABLE 23. PERCENTAGE OF SUBJECTS REACTING SPECIFICALLY.

Age	*0;0 + 10 — 0;1*	*0;1 — 0;2*	*0;2 — 0;3*
To the bib (60 subjects)	—	75	83
After interrupted nursing (30 subjects)	30	80	90

in so far as the favoring factor of the mother's aid is omitted from the nursing procedure in Series VIII. As the factor of smell was also found to play no rôle, the nursed baby had no advantage on this score either. Sight stimuli are negligible in both groups, and the auditory stimuli of spoken words is practically the same for both.

The only two factors to be found present under the nursing conditions and lacking in the bottle-feeding are: the physical contact with the mother, and the characteristic nursing posture. It was the purpose of Series IX and X to isolate these two factors further in an attempt to ascertain which was effective in eliciting the specific reactions.

17. The Rôle of Physical Contact and Posture

The problem of Series IX was to determine whether specific feeding reactions could be elicited in the absence of the nursing posture, i.e., when the infant, at feeding time, is taken up and placed in a position which permits of nursing, but at the same time differs from the usual nursing position. Inasmuch as this involved a non-customary procedure, and it was a matter of importance to carry it out exactly, the mothers were not

used in this series and the next, a psychological assistant acting in their stead. There were 10 subjects ranging in age from 0;0+12 to 0;2+15. These were lifted out of the crib by the assistant and held in a *vertical* position so that the infant's face was turned toward the breast.

It is difficult to analyze the component elements of a physical contact. In addition to slight movements such as pulsations, for example, which escape the eyes of the observer, involving kinaesthetic sensations for the child, there are those of pressure, touch, and temperature. Still another element has been more abstractly expressed as a love relation between mother and child. This implies a particular, pleasant sensation coming from the parental contact. Watson (26) found the "love response" elicited specifically by stroking the skin. Shinn (20) has a corroboration of this finding in that she observed expressions of comfort when the baby was stroked or fondled. It is often observed that an infant may be quieted by laying a hand on his head, i.e., merely by a human touch. Whatever the elements of physical contact may be they undoubtedly vary with the individuals involved. The question arises whether the factor of physical contact, then, has been kept constant. Where the experimental procedure of Series IX substituted another individual for the mother it accordingly modified this factor. It was, however, impossible to determine whether this modification was perceived by the child. At any rate the situation consisted of the usual nursing elements, including a physical contact, with the factor of posture varied. The results of this series are that in no case was a specific reaction manifested. This shows that a physical contact alone is insufficient to set off the appropriate feeding response.

By a process of elimination it would seem that the characteristic nursing position, and factors closely connected with it, is the cue which elicits the specific feeding reactions. Series X clinches this evidence. Here all the preliminaries of diapering, fondling, spoken words, weighing, etc., were omitted. The assistant simply took the hungry infant out of the crib and placed him in her lap, holding him in the nursing position without, of course, baring the breast. This was tried with 12 subjects ranging in age from 0;0+11 to 0;2+15. The four subjects below 0;1 reacted negatively; two out of four in the second month, however, and all four in the third month re-

acted positively, showing specific feeding reactions. Comparing these results with those in the natural and interrupted nursings (see Table 23), and allowing for the difference in the number of cases, shows practically the same percentage of specific reactions occurring when the postural factor is present to the exclusion of all others as when the situation is complete. This points again to the nursing posture as the cue element in the whole feeding set-up. Bechterew's (1) results, to be described below, were of the same nature, and Blanton (2) makes the following similar contribution. "Experiments on placing infants to the breast to quiet them were made as early as the 3rd day of life, and as the amount of milk gotten up to that time is negligible it is fair to assume that *changes in the position* or pressure was the cause of the resulting quiet." (Italics mine.)

There is significant evidence, however, on two scores to show that Series X does not give the stimulus of posture in true isolation. Firstly, when the results of this series are compared with those of Series VIII, the interrupted procedure, there is a striking difference in favor of the latter. It will be recalled that the posture was retained and in no way disturbed when the drinking was broken off. Consequently there must be some element of *getting into position*, the movement of being brought close to the mother and the breast, of being brought into the nursing posture, which exercises a particular potency in eliciting the specific feeding behavior from the infant. It may be noted that some writers claim the kinaesthetic sense to be developed the earliest of all, and it is a familiar fact that sudden changes of posture, such as those occasioned by dropping, cause reactions of a definite nature shortly after birth.

A second point to be considered is the presence of physical contact which is so elusive of analysis and yet so integral and essential to the situation. Bechterew (1) finding an absence of specific reactions when presenting nursing stimuli to infants lying on their backs in a crib, and observing specific manifestations when placing them in the nursing position in the arms of a male experimenter, concluded that the posture was the element to which the reaction was conditioned. However, his criterion of a specific response was the sucking movement alone which, as shown above, cannot be accepted at this age as a reaction specific to the feeding situation. Further-

more, the fact that physical contact, including warmth, etc., was absent under the first set of conditions and present under the second (even though furnished by a male) invalidates his conclusion.

The present study attempted to separate these two elements. It succeeded in isolating physical contact, presenting it with a variation of the postural element. The resulting conclusion was that physical contact alone is ineffectual in eliciting the specific response. No way was found, however, of achieving the typical nursing position in the absence of physical contact. To what extent the nursing posture and the movement which initiates it alone are capable of eliciting this response remains, therefore, an open question. It might be very well that the cue element of the nursing situation, for which this study was searching, is a composite consisting of a combinaiton of the *postural* element, its initiating *movement*, and the factor of *physical contact*.

18. Summary

1. The neonate is incapable of making active adjustments in seeking or obtaining nourishment. Feeding reactions are elicited only by direct contact in the region of the cheek and mouth.

2. His repertoire of responses increases from one feeding to the next during the first week of life.

3. Specific reactions were observed in nursing at the completion of the first month.

4. Successful reactions were observed during the first half of the second month.

5. The sense of smell plays no part in eliciting a specific response.

6. Physical contact, which occurs as a part of the normal nursing situation, is incapable of eliciting a specific response when presented alone.

7. The cue element, i.e., that detail of the whole nursing situation to which the child reacts, is a combination of the peculiar nursing posture, the movement which initiates it, and the physical contact with the mother.

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